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CONSTELLATION



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- The NASA Supply Chain to be
- Simulation and SCOR
- SCC SCOR as an Efficient Approach for Managing and Understanding the Complexity in the NASA Exploration Supply Chain



The NASA Human Space Flight Supply Chain... On Earth...



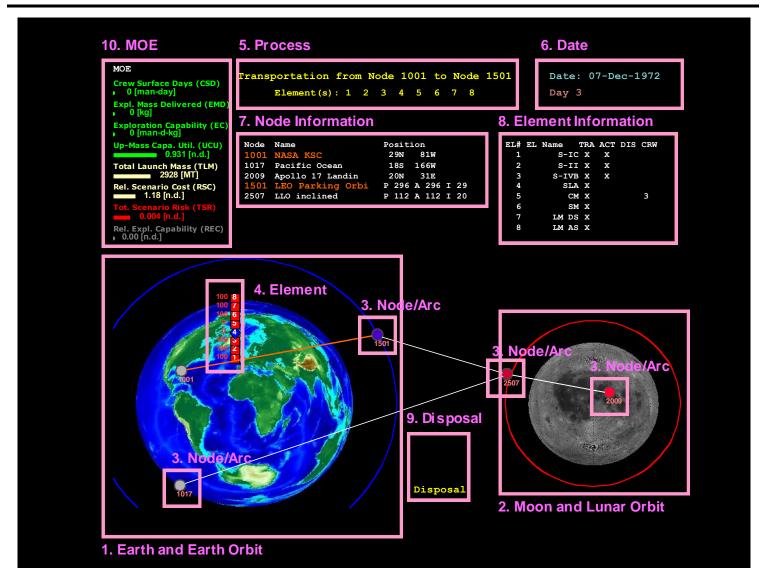


Courtesy of: http://www.frassanito2.com/SSPO/suppliers/



The NASA Human Space Flight Supply Chain... Extending to Space...



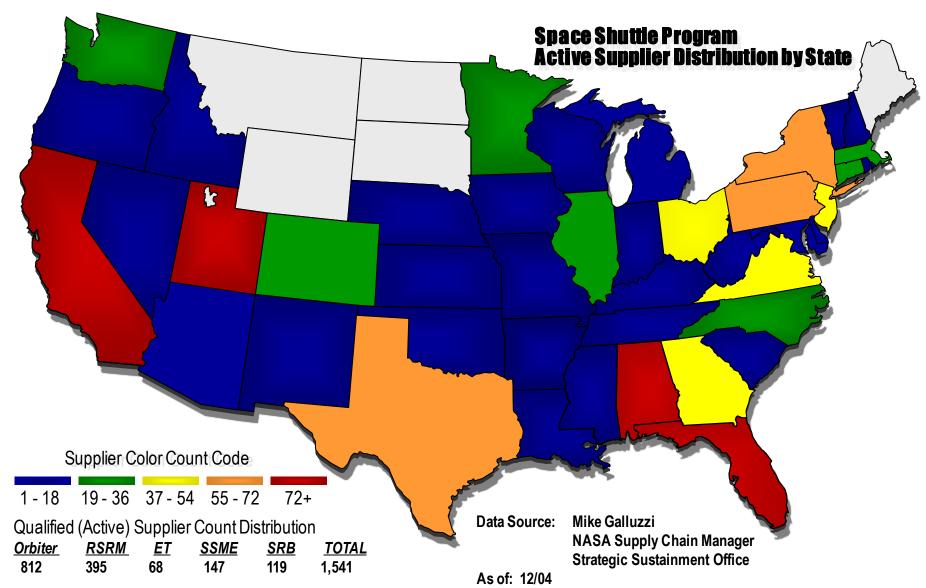


Courtesy of: http://spacelogistics.mit.edu/about.htm



A Supply Chain of over 1500 Suppliers...







A Space Shuttle Operation Flowing:



- ◆ ~\$1B per year in material purchases as items, flight and ground element hardware, projects and tangible goods
- + ~\$3B per year in information as services, labor and intangibles
- ...in a low volume market with set demand for the transportation product of about 5 launches per year...
- ...with flight and ground technology that is usually custom, developing and not mature by commercial standards, and also low volume...
- …incurring variance in all parts and processes, due to low volumes…
- ...while morphing into a new product line simultaneous with on-going operations...
- ...fulfilling as payload and ultimate "deliver-able" the parts and the in-space construction of an International Space Station in Low-Earth Orbit.





Amidst flawed tracking systems for following the money...



Follow the money



(...if you can)

- In May of 2004, the Government Accounting Office sent a Report to the Subcommittee on Space and Aeronautics, Committee on Science, House of Representatives
 - "NASA's lack of Disciplined Cost-estimating Processes Undermines NASA's Ability to Effectively Manage its Programs".
- Numerous other similar critiques have surfaced over the decades...

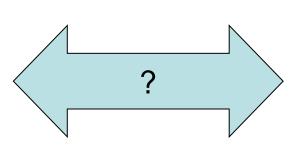


Supply Chain Scope...two extremes...



Logistics is improved by good supply chain management

SCM as "deliver" only part of an organization



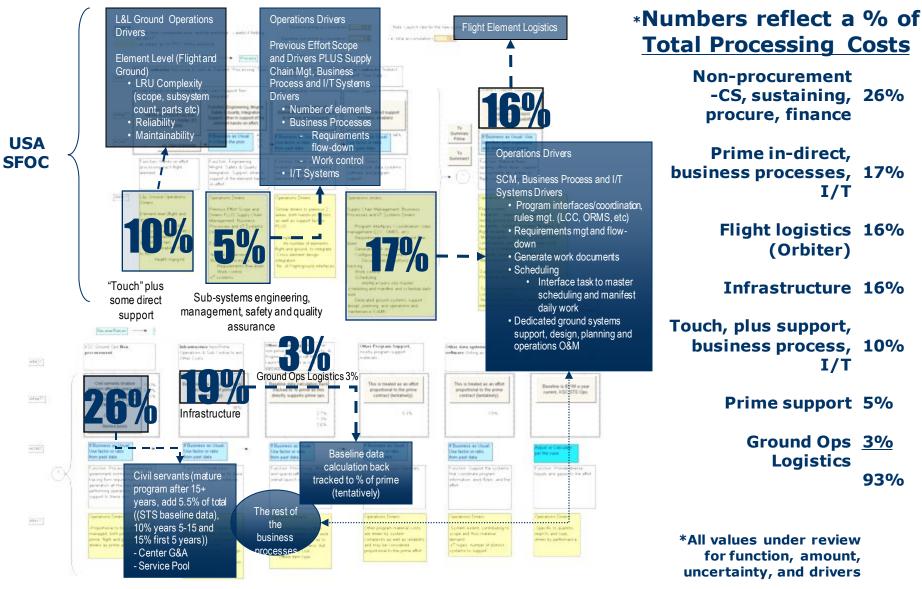
We are here

The combination of art and science that goes into improving the way your company finds the raw components it needs to make a product or service, manufactures that product or service and delivers it to customers. Plan, make, source, deliver, return. Supply-Chain Council



Perspective, Kennedy Space Center Shuttle Ops





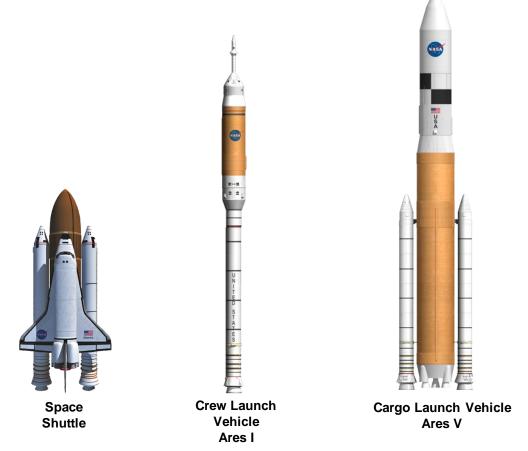


NASA Future Plans & Needs



Flight Systems

- From one launch, to a two launch solution
- From Low-Earth orbit only operations to Lunar and Planetary capability

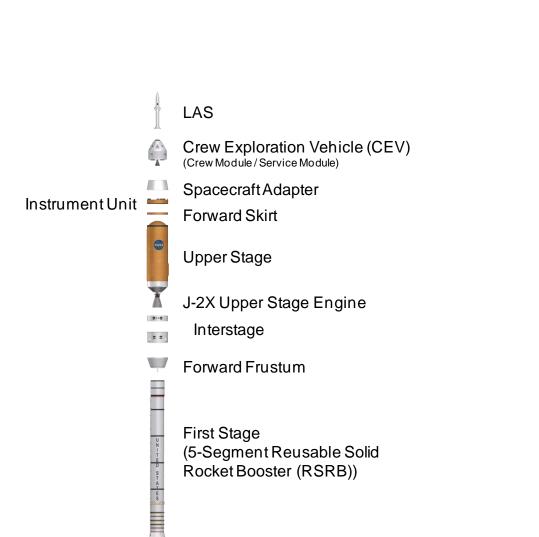


The NASA Exploration Supply Chain, SCOR, Simulation & Analysis



Constellation Launch Vehicle Elements







Composite Shroud



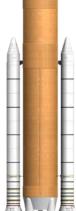
LSAM



EDS Stage LOx/LH2 One J2S+ Engine Al-Li Tanks/Structures



Interstage



Core Stage LOx/LH2 Five RS-68 Engines Al-Li Tanks/Structures

Two 5-Segment RSRBs

Ares I Crew Launch Vehicle

Ares V Cargo Launch Vehicle



NASA Future Plans & Needs



Ground Systems

 Migrating from reusable systems being processed to receipt of more expendable elements...







Our Exploration Supply Chain Definition



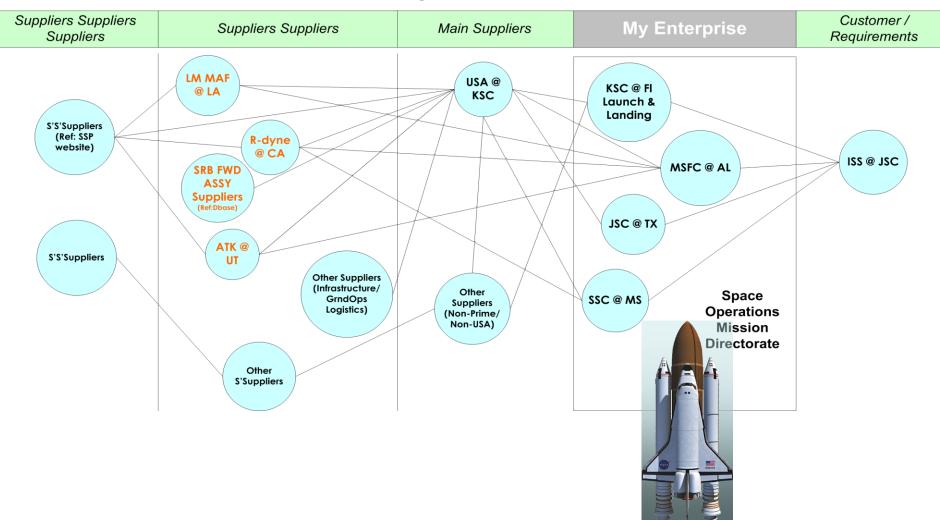
• We define an Exploration Supply Chain as:

The integration of NASA centers, facilities, third party enterprises, orbital entities, space locations, and space carriers that network/partner together to plan, execute, and enable an Exploration mission that will deliver an Exploration product (crew, supplies, data, information, knowledge, and physical samples) and to provide the after delivery support, services, and returns that may be requested by the customer.



The NASA Human Space Flight Space Transportation Supply Chain "As-is" viewed as an Enterprise Level Network

The Space Operations Supply Chain "As-is" Space Shuttle as a Relationship Network of Enterprises –
These exchange Materials or Information

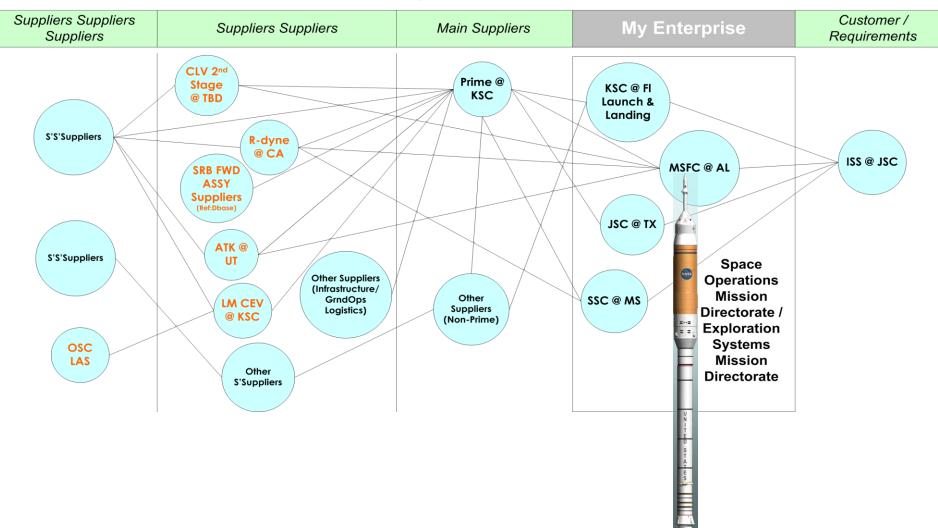


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The NASA Human Space Flight Space Transportation Supply Chain "To-be" viewed as an Enterprise Level Network

The Space Operations Supply Chain "To-be" Orion / Ares I as a Relationship Network of Enterprises –
These exchange Materials or Information



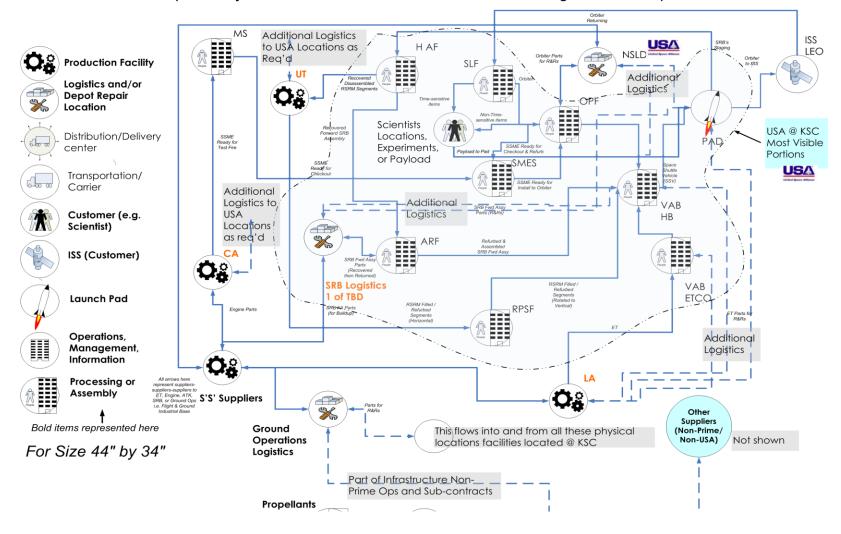
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The NASA Human Space Flight Space Transportation Supply Chain "As-is" viewed as an Functional Units...

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The Space Operations Supply Chain "As-is" Space Shuttle as Physical Locations of Major Enterprise Physical Functional Units – Each of these belongs to an Enterprise

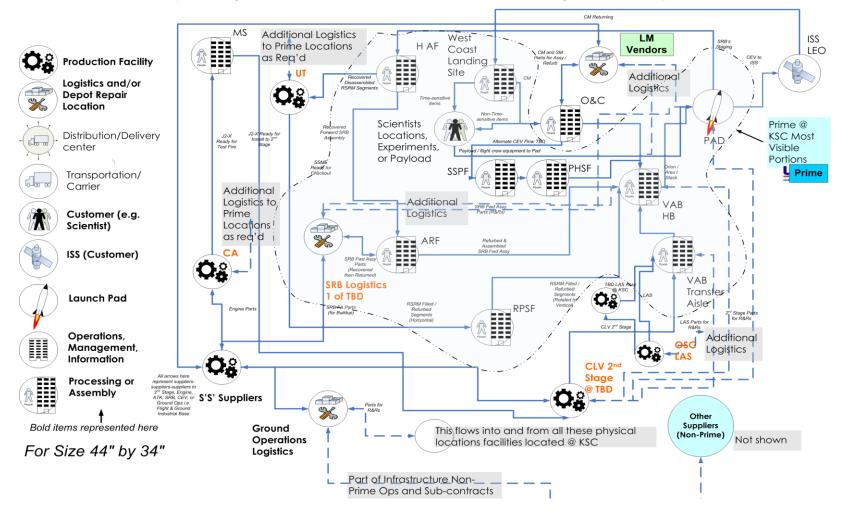




The NASA Human Space Flight Space Transportation Supply Chain "To-be" viewed as an Functional Units...

+ + CONSTELLATION

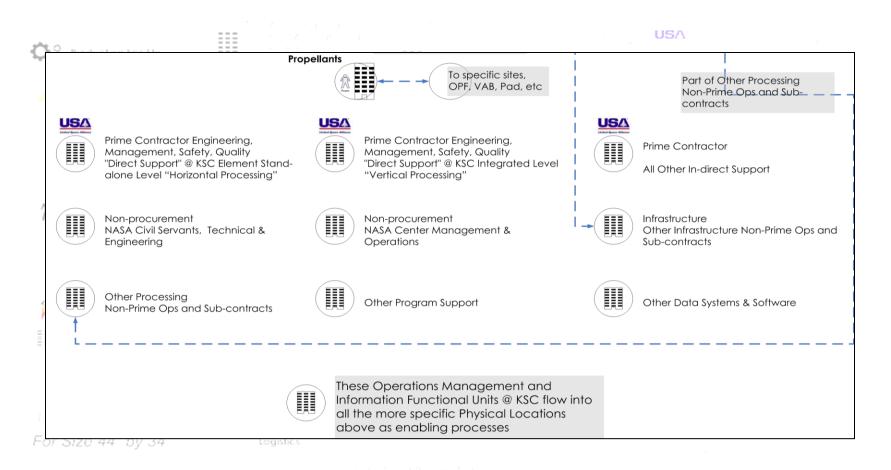
The Space Operations Supply Chain "To-be" Orion / Ares I as Physical Locations of Major Enterprise Physical Functional Units – Each of these belongs to an Enterprise





The NASA Human Space Flight Space Transportation Supply Chain "As-is" viewed as an Functional Units...and Resources

The Space Operations Supply Chain "As-is" Space Shuttle as Physical Locations of Major Enterprise Physical Functional Units – Each of these belongs to an Enterprise



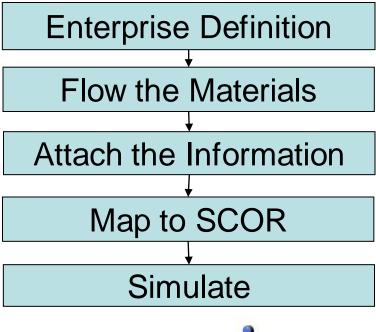
Propellants

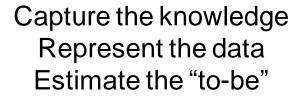


Simulation and SCOR - E₂0 Supply Chain Sim

http://science.ksc.nasa.gov/shuttle/nexgen/supply_chain_main.htm



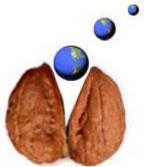






The Exploration Earth-to-Orbit Supply Chain Simulation project —

- •NASA KSC
 - •Edgar Zapata, PI
 - Mike Galluzzi, Shuttle SC Manager
- Productivity Apex Inc. of Orlando FI.
 - Sam Fayez, Ph.D
 - Mansooreh Mollaghasemi Ph.D

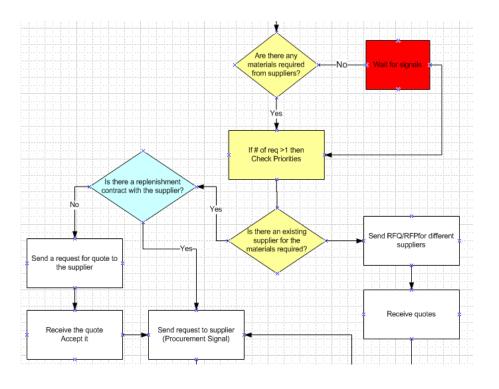




E₂0 Supply Chain Sim Scenario Analysis



- Capability to analyze different, advanced operating scenarios and new initiatives:
 - New designs & architectures
 - Practices
 e.g. VMI / VOI,
 RFID, e-Shop
 Floor,
 commonality,
 modularity, etc.

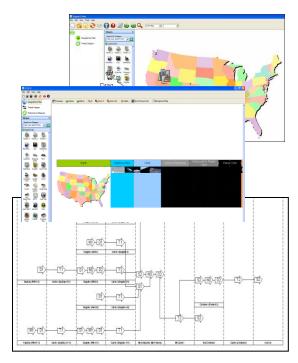




E₂0 Supply Chain Sim The Interface



- Define a Supply Chain on a geographic and Space-time map.
- Automatically generate the process flow of the end-to-end
 Space Exploration Supply Chain
- Automatically generates the Key Performance Indicators relevant to the Supply Chain







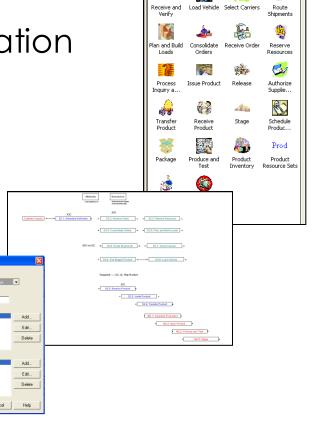
E₂0 Supply Chain Sim The Simulation



Test and

Supply Chain 5

- Simulation templates consistent with SCOR – Plan, Source, Make, Deliver, and Return
 - Automatically generate simulation models.



Pick Staged

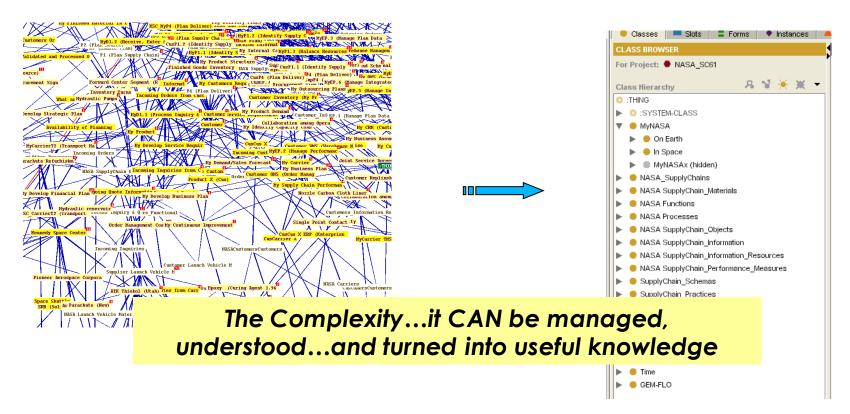


E₂0 Supply Chain Sim Visualize the improvements...



Ability to model "what-ifs" that follow both time and money Improvements by:

- Understanding the supply chain at a strategic level
- Design of the supply chain
- Application of best practices quantified as to potential effects



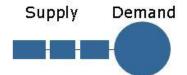


How dynamic is the future state? Shaping demand rather than accepting it.



Present State

Linear, push manual practice

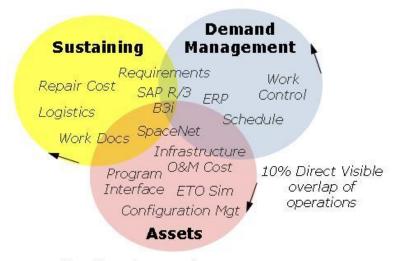


10% is what we see...results... and all that "other processing stuff" where the time and money is...90% what we don't see.



Accepting demand
New technology an exception
Deterministic optimization

Future State Circular, self-renewing simulation model



Shaping demand Embedded technology insertion Probabilistic planning optimization



Also Using SCOR: ESATA "LLEGO"

http://science.ksc.nasa.gov/shuttle/nexgen/ESATA_main.htm



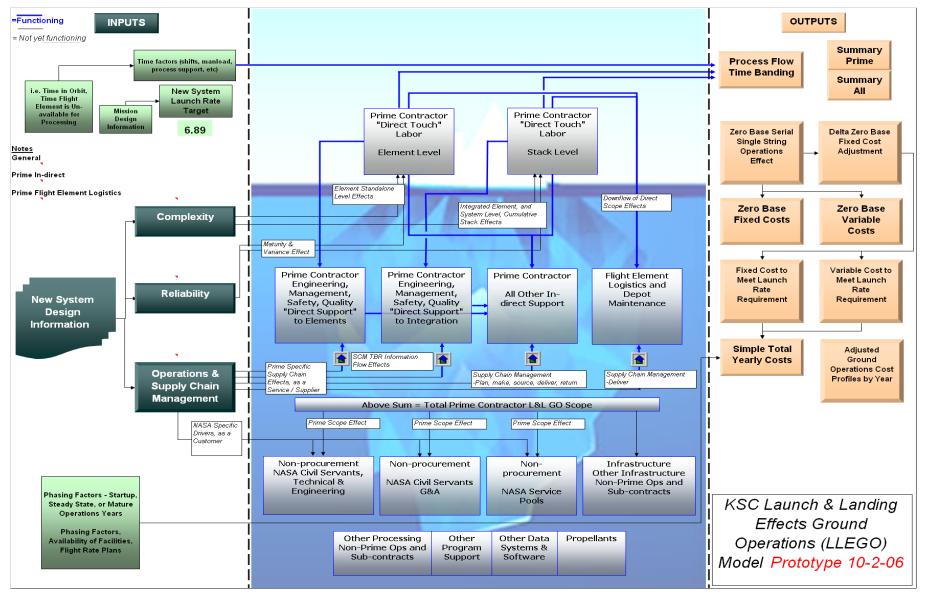
- Explorations Systems Analysis and Technology Assessment Project
 - This research and development project:
 - Will create a model that provides linkage between the what, how and why of Launch and Landing costs and flow times, reflecting on future affordability and responsiveness for space launch, specifically the Exploration architecture.
 - Locate the rudders
 - Communicate to key decision makers and stakeholders
 - Quantify
 - Model



ESATA & The Iceberg: Root Influences, \$ and Time

http://science.ksc.nasa.gov/shuttle/nexgen/ESATA_main.htm





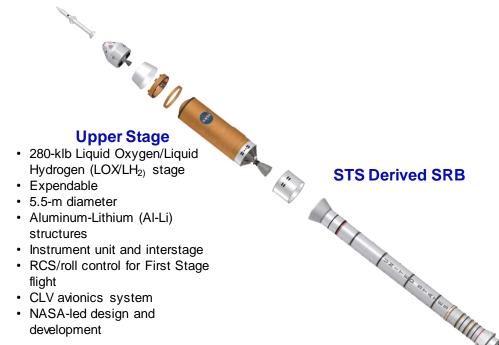


ESATA & The Iceberg: Root Influences, \$ and Time

http://science.ksc.nasa.gov/shuttle/nexgen/ESATA_main.htm



- Complexity and reliability influence product outcomes such as cost, safety, responsiveness (time to process a launch) and growth potential.
- Strive to establish, understand and quantify design operability drivers and influence on the product outcomes
- Work with designers, collaborate early and often





CEV/Orion Crew

Exploration Vehicle





- ◆ Project "E₂O SC Sim" is currently go through November
 - Project runs through June 2007.
- Project "ESATA / LLEGO" is go through August 2007
- Work to date has shown:
 - SCC SCOR as an Efficient Approach for Managing and Understanding the Complexity in the NASA Exploration Supply Chain
 - Ability to connect knowledge based ontology approach to an automatically generated simulation via a graphic user interface
 - Program once, use many times!
- ◆ A Supply Chain Perspective has already proven useful in just organizing data – what is flowing? Where? Why? What information is virtual? What are the enabling processes? The match to "resources" and NASA flow of product, even at low volume, is especially applicable.



Backup

